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A new *Phylloporus* from two relict *Fagus grandifolia* var. *mexicana* populations in a montane cloud forest

Leticia Montoya* & Victor M. Bandala

Instituto de Ecología, A.C., Biodiversidad y Sistemática, P.O. Box 63, Xalapa, Veracruz 91000, Mexico

*Correspondence to *: *leticia.montoya@inecol.edu.mx*

Abstract — A new species, *Phylloporus fagicola,* has been discovered growing in association with two relict populations of *Fagus grandifolia* var. *mexicana* in the subtropical region of central Veracruz (eastern Mexico). The species belongs to a taxonomic group characterized by broadly ellipsoid oblong to ovoid basidiospores, distinct from the subfusoid boletoid type. The new taxon is described, illustrated, and compared with closely similar species.

Key words — ectomycorrhizal fungi, neotropical fungi, gilled *Boletales*, taxonomy

Introduction

Currently, *Phylloporus rhodoxanthus* (Schwein.) Bres., *P. bellus* (Massee) Corner, *P. phaeoxanthus* var. *simplex* Singer & L.D. Gómez, *P. foliiporus* (Murrill) Singer, *P. centroamericanus* Singer & L.D. Gómez, and *P. guzmanii* Montoya & Bandala have been recorded from Mexico (Singer 1957, Singer 1978, Singer & Gómez 1984, Montoya et al. 1987, Montoya & Bandala 1991). Those records represent a low proportion of the 24 *Phylloporus* taxa known to occur in the Neotropics (Neves & Halling 2010). A new species described here, *P. guzmanii* from Mexico, and *P. aurantiacus* Halling & G.M. Muell. from Costa Rica (Halling et al. 1999), form a group of American taxa distinguished by broadly ellipsoid, oblong, or ovoid shaped basidiospores that differ from the boletoid (subfusoid) basidiospores typical of other *Phylloporus* species (Corner 1970, Heinemann & Rammeloo 1987, Neves & Halling 2010). The *Phylloporus* species previously reported from Mexico have been recorded growing with *Quercus* or *Pinus*. The new species described here represents the first Mexican record of a *Phylloporus* growing in association with *Fagus grandifolia* var. *mexicana* (Martínez) Little.

Materials & methods

Between September 2005 and September 2009 in the State of Veracruz, random surveys were conducted in two *Fagus grandifolia* var. *mexicana* stands in Mesa de la

Yerba (Acajete; 19°33′37.2″N 97°01′9.8″W, 1900 m) and Acatlán Volcano (Naolinco-Acatlán Road, Acatlán; 19°40′43.9″N 96°51′9.8″W, 1840 m).

Macromorphological characters were recorded from fresh sporocarps. Alphanumeric color codes refer to Kornerup & Wanscher (1967) and Munsell (1994) (e.g. 2.5Y 5/2). Micromorphological features were recorded in 3% potassium hydroxide water solution. Basidiospore measurements were determined according to Montoya & Bandala (2003), with 45–50 spores measured per collection and where X_m = length × width range of means and Q_m = the mean length/width ratio for n collections. Line drawings were made with the aid of a drawing tube. The examined specimens studied are now deposited in XAL herbarium. Acronyms for the herbaria follow Holmgren & Holmgren (1998).

Taxonomy

Phylloporus fagicola Montoya & Bandala, **sp. nov.** Figs. 1–7

MycoBank MB 519849

Pileus 10–53 mm latus, primo hemisphaerico, dein late convexo vel applanato, sicco, velutinosus, subtomentosus, tenuis squamulosus vel glabro ex parte et ad marginem, aurantioruber, flavus ex parte, cyanescens, cum NH_4 caerulescent. Lamellae decurrentes, confertae, septis connexae, furcatae circa stipitem, crassae, flavidae, rufo maculatae, cyanescens. Stipes 13–40 × 2–7 mm, centralis vel eccentricus, firmus, rufo, aurantioruber, velutinosus, basi villosa. Contextus flavus ad pileus, brunneo-rufo ad stipes, cyanescens, cum NH_4 caerulescent. Basidiosporae 6.5–10.5(–11) × 4–7(–7.5) µm, ellipsoidae, oblongae olivacei-flavae. Pleurocystidia 84–132 × 7.5–13 µm, subcylindrata, subfusiformia, ventricosa, sinuosis, numerosa; pariete tenui vel incrassatus (0.8–3.5µm). Cheilocystidia 26–114 × 4.8–12(–13) µm, clavata, subcylindrata, subfusiformia, interdum mucronata, numerosa; pariete tenui vel incrassatus (–2.5 µm). Pileipellis primo cutis instructa dein intermitto cum numerosis tumulus catenulatis hyphis, cellulae terminales clavatis, subcylindraceis, ventricosis, subfusiformis (12–55 × 3.5–7 µm). Hyphis defibulatis.

Holotypus**:** *Ad terram in silvis. Mexico. Veracruz, Mpio. Acatlán, Acatlán Volcano, August 21, 2007, del Moral 82 (XAL).*

Pileus 10–53 mm diam., subhemispheric when young, plane-convex to plane, reddish-orange (7C8–B8, 7D6) with some intense bright yellowish tones, yellowish-orange (6B–C8, 10YR 8/8), brick orange to brick-red (2.5YR 4/6–4/8, 3/6), in some areas orange (6B8) and with a yellow ground or towards the margin (3A7, 10 YR 6/8), this latter at times discolouring, bluing to blackening when bruised, dry, pruinose to velutinous, subtomentose to faintly squamulose or subfloccose towards the center, glabrous and smooth in some areas and towards the margin or faintly pruinose at margin, cracked in some areas. Lamellae decurrent, thick, broad, 5–8 mm broad, close to crowded. Lamellulae of 3–5 different lengths, at times furcate towards the stipe attachment, with interparietal veins, joined in "H appearance", egg yellow when young to yellow with orange tinges (5A7–8, 5B7, 6A6–B7) or in age yellow with red (8D8) irregular stains or almost totally red mainly towards the stipe attachment, staining green-blue, bluish-brown (25D6) to grayish-black or blackish, margin

Fig. 1. *Phylloporus fagicola* (Garay 215).
Bar = 10 mm.

irregular. Stipe 13–40 × 2–7 mm, subcylindrical, attenuated towards the base, velutinous to finely furfuraceous towards the apex, central to excentric, dry, firm, apex sulcate by the decurrence of the gills, reddish-orange (8C7), reddish (10C8), vinaceous-brown (7E8) or brick-orange (2.5 4/8), reddish-orange (6B8) at apex, yellow towards the base (4A6–5) but frequently stained dark grayish to blackish; base at times villose, yellowish, with rhizomorphs. Context bright yellow (3A6, 7B7) to egg yellow (4A7–8) at pileus; vinaceous-brown to reddish-orange (7D6–D7) at stipe; staining deep blue (23D7–D8) mainly on stipe area. Odor agreeable, fruity (recalling citrics). Machrochemical reactions: NH4OH stains greyish-black, greenish on pileus; blue, greenish-blue on context. KOH stains yellowish-brown on pileus and lamellae and orange-brown on context.

Basidiospores 6.5–10.5(–11) × 4–7(–7.5) µm, X_m = 7.0–9.0 × 4.2–5.1 µm, Q_m= 1.53–1.78, ellipsoid to oblong, obtuse, yellowish-green, smooth, thin-walled. Basidia 46–60 × 6–7 µm, clavate, subcylindrical, sinuous, attenuated towards the base, bisporic or tetrasporic, sterigma up to 8.5 µm long, with yellow contents. Pleurocystidia 84–132 × 7.5–13 µm, subcylindrical, subfusoid, sinuous, ventricose, frequently thin-walled but other with wall 0.8–3.5µm thick, projected from below the hymenium, abundant, yellow in KOH. Cheilocystidia 26–114 × 5–12(–13) µm, clavate, subcylindrical, mucronate,

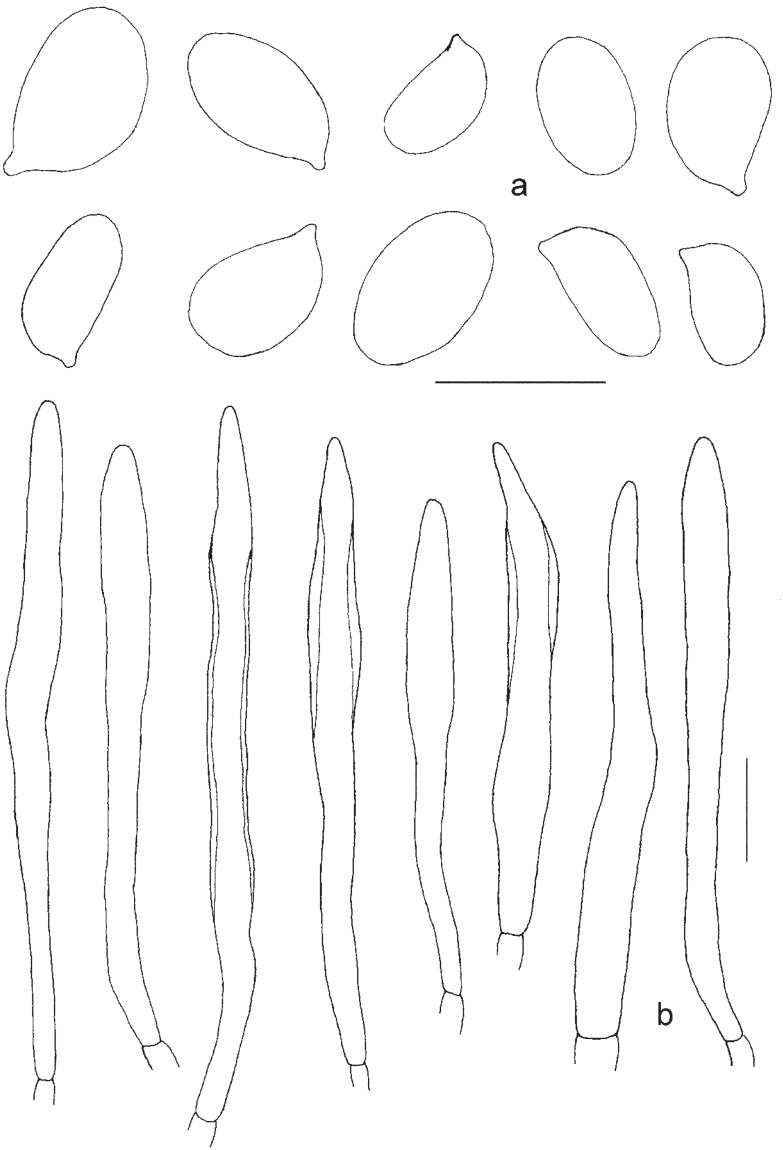

Fig. 2. *Phylloporus fagicola*.
a. Basidiospores (del Moral 117). b. Pleurocystidia (del Moral 82, holotype).
Bars: a = 10 µm, b = 20 µm.

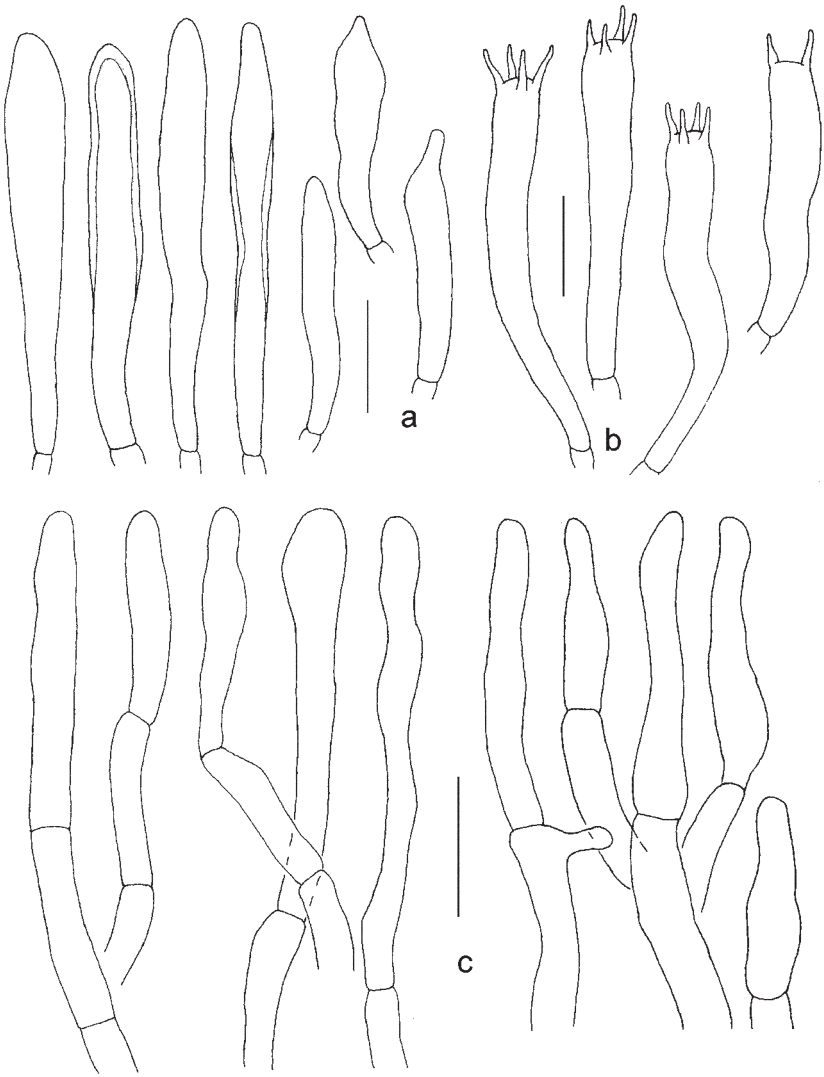

Fig. 3. *Phylloporus fagicola*.
a. Cheilocystidia. b. Basidia. c. Terminal elements of pileipellis.
(a–b = del Moral 82, holotype; c = del Moral 292). Bars = 20 µm.

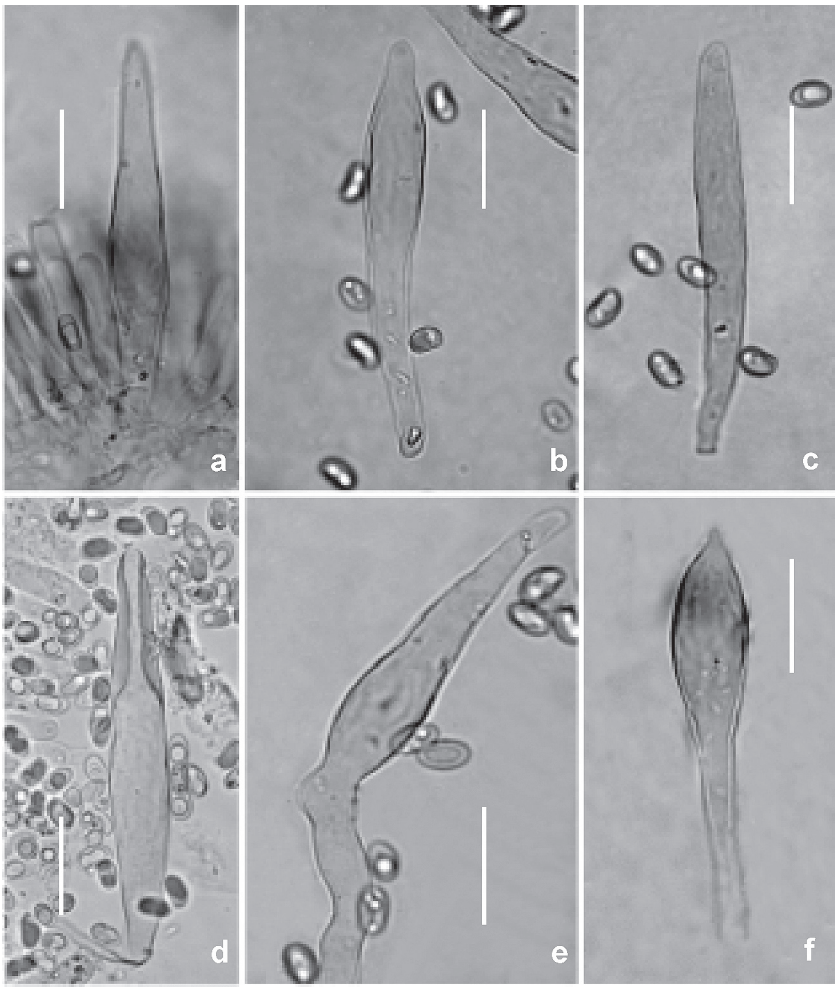

Fig. 4. *Phylloporus fagicola*. Pleurocystidia.
(a–c: Garay 215; d–f: del Moral 82, holotype). Bars = 20 µm.

subfusoid, thin-walled, other thick-walled up to 2.5 µm, or with incrustations, yellow in KOH, the measurements include mucronate subcylindrical or moderately ventricose sterile elements, 26–45 × 5–8 µm present at lamellae edges. Pileipellis a cutis of loosely intermixed hyphae when young, becoming as an interrupted layer of frequent mounds of chains of elements disposed in anticlinal orientation, loosely intermixed, with terminal cells clavate ventricose, subfusoid, subcylindrical, 12–55 × 3.5–7 µm, intercalary elements 12–38 ×

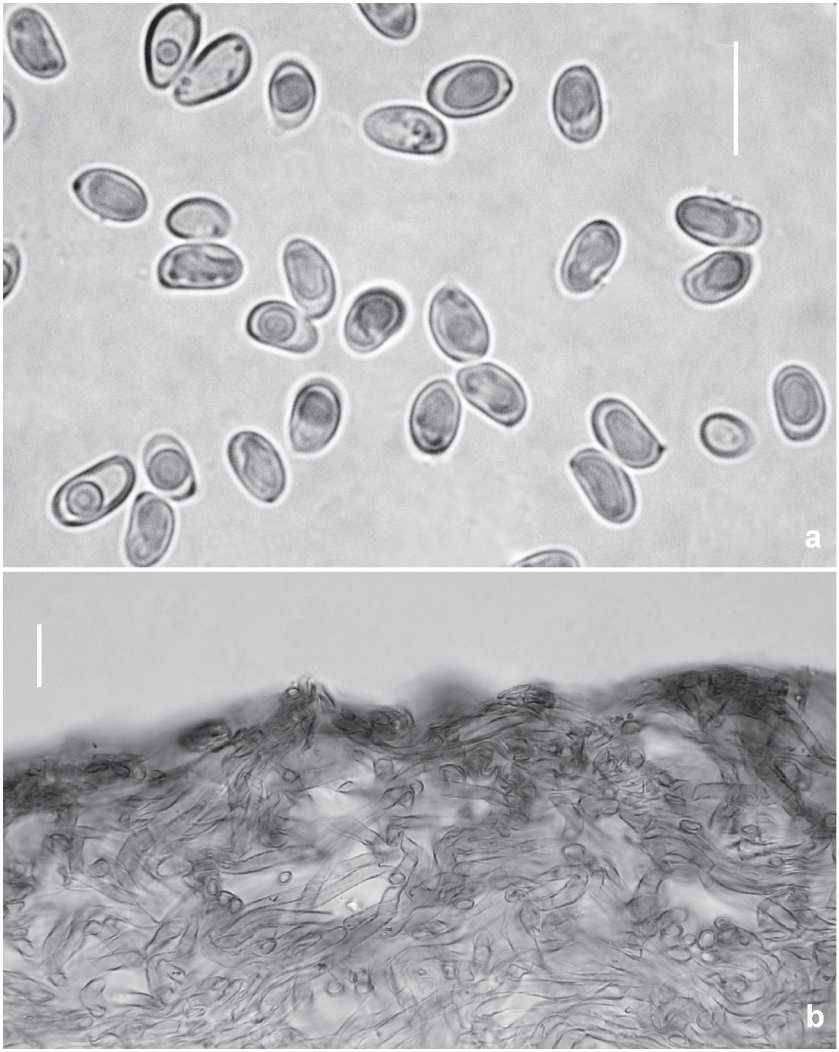

Fig. 5. *Phylloporus fagicola*. a. Basidiospores (Garay 215). b. Pileipellis (Montoya 4721). Bars: a = 10 µm, b = 20 µm.

3.5–6 µm, the mounds are variable in height and in some basidiomes arranged in a dense disposition, the hyphae appear more loosely arranged towards the context, all the elements yellow-amber in KOH, thin-walled. Context hyphae yellowish in KOH, hyphae loosely arranged 7–12 µm broad. Hymenophoral trama hyphae 3–12 µm broad, thin-walled, some with thick wall up to 2.5 µm

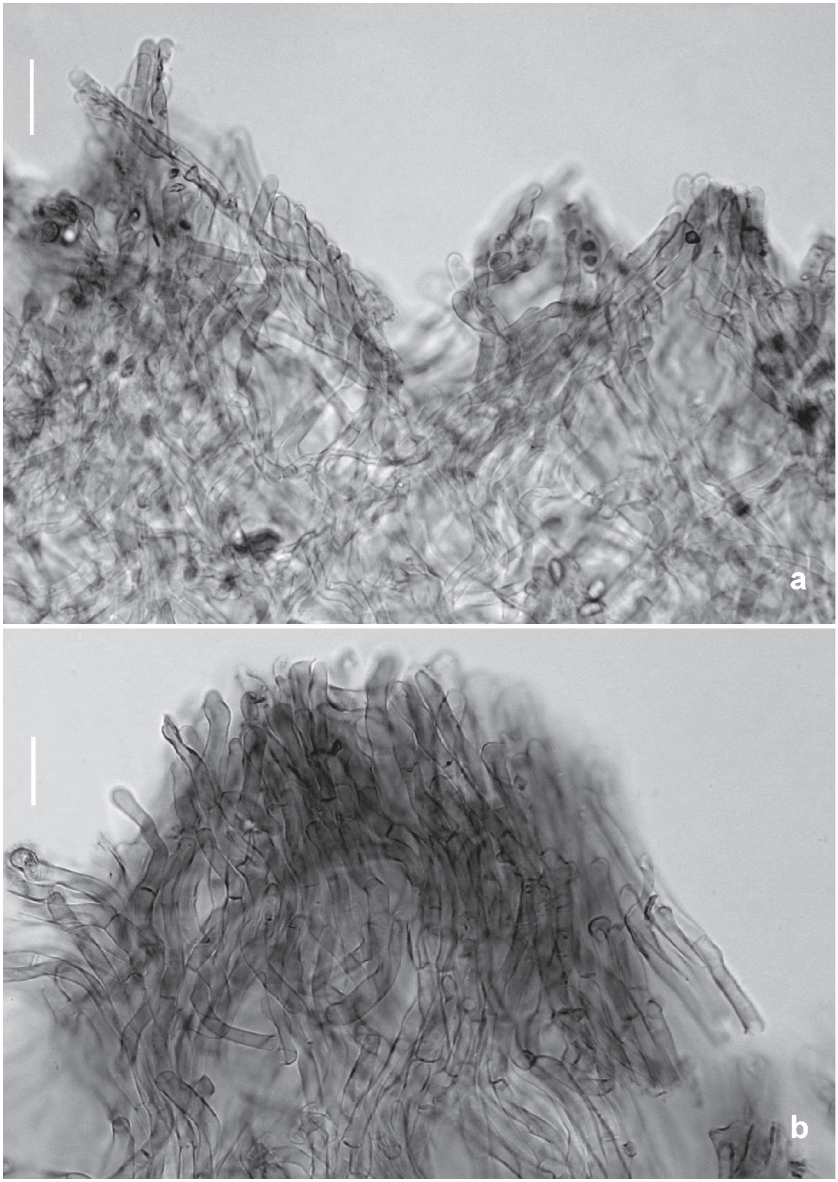

Fig. 6. *Phylloporus fagicola*, pileipellis (a: del Moral 82, holotype; b: del Moral 66). Bars = 20 μm.

or with incrustations, other with dense, refractive contents. The tissues exude an intense yellow sap when mounted in KOH.

Habitat — Gregarious in naked soil with dead leaves or with mosses in a *Fagus grandifolia* var. *mexicana* forest at 1840 m.

Additional specimens examined (all conserved at XAL): **MEXICO. Veracruz:** Mpio. Acatlán, Acatlán Volcano, August 14, 2007, del Moral 66; September 18, 2007, del Moral 117; September 10, 2008, del Moral 292; September 29, 2009, Garay 215. Mpio. Acajete, Mesa de la Yerba, August 8, 2006, Montoya 4606; October 22, 2008, Montoya 4721.

Discussion

Phylloporus fagicola is distinguished by the following features: a short, medium-sized basidiome, brightly colored (red-orange with yellow tones with egg-yellow to orange-yellow lamellae) but with context and surfaces bruising blue, crowded lamellae, thick-walled cystidia, and pileipellis at first a cutis and developing frequent mounds of anticlinal chains of elements when mature.

Among other *Phylloporus* taxa with ellipsoid to oblong basidiospores, *P. guzmanii* is distinguished by a vinaceous-red to dark purple pileus and stipe, gills that are more distant and lighter yellow, slightly narrower basidiospores [(6.4–)7.2–8.8(–10.4) × (3.2–)4.0–4.8(–5.6) µm], thin-walled and somewhat shorter cystidia [pleurocystidia (41.6–)45.0–105.6(–116.8) × 5.6–11.0(–12.0) µm; cheilocystidia 72.0–80.4 × 6.4–11.2 µm], and a trichodermial pileipellis with larger terminal elements [(20–)22–78(–80) × 5.5–10 µm]. *Phylloporus guzmanii* was recorded from Central and SW Mexico, growing in mesophytic *Quercus* and *Pinus* forests (Montoya & Bandala 1991).

Phylloporus aurantiacus, which possesses oblong basidiospores that are shorter (5.6–7.7 × 3.5–5 µm, X_m = 6.8 × 3.5 µm) and more ovoid in shape, is also distinguished by unchanging flesh when exposed, lamellae lacking red stains, shorter (60–90 × 7–10 µm) thin-walled cystidia, a trichodermial pileipellis, and an association with *Quercus* (Halling et al. 1999).

Phylloporus coccineus Corner from Singapore, also with broadly ellipsoid basidiospores that are somewhat shorter [7.5–9(–10) × 6.5–7.5(–8) µm] and more globose, differs from *P. fagicola* in subdistant gills, thin-walled larger cystidia [pleurocystidia 200 × 10–16 µm; cheilocystidia 70–120 × 10–18 µm], and a pileipellis comprising a compact palisade of terminal elements (25–40 × 5–10 µm) with reddish-orange sap and slightly thickened pink walls (Corner 1970).

During repeated surveys of both sites, the *P. fagicola* specimens fruited infrequently compared with other species recorded in the area. The new species appears to associate with *Fagus grandifolia* var. *mexicana* and has not yet been found in other montane cloud forest fragments of surrounding the area or in other regions explored by us.

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